# *The* REAL BOOK *of*

# *SCIENCE EXPERIMENTS*

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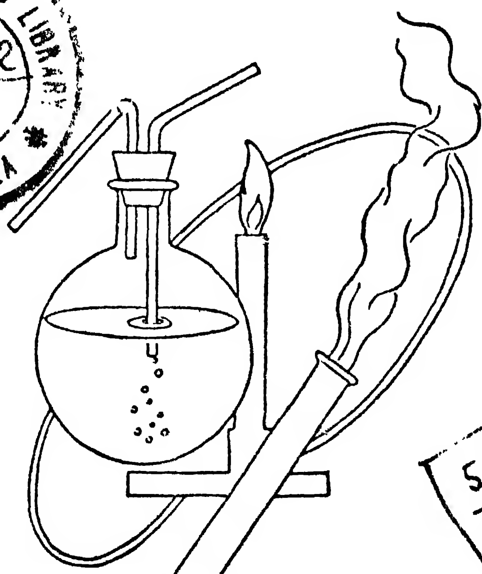



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## Contents

## A WORD TO BEGINNING SCIENTISTS

DO YOU WANT to find out exciting facts about the physical world? If you do, the best way to go about it is to do your own science experiments.

Scientists have found out *how* natural forces act, and *why* they act the way they do, by experimenting. They have learned how air, water, electricity, heat, cold, light and sound and other natural forces work. By doing the experiments in this book you can demonstrate these things for yourself, in your own home.

Most people are apt to think of a scientific experiment as something that has to be done in a big laboratory where solemn men in white uniforms work with test tubes and other special equipment. That just isn't true at all! There are hundreds of fascinating experiments that you can do easily with common materials found in almost every kitchen. Glasses and bottles can be your test tubes and beakers. Balloons, paper bags, and kettles can serve as your scientific equipment.

You don't need any knowledge of science to do these experiments. All you need is curiosity! But as you go along you will learn quite a bit about science that you did not know before. You can amaze your

friends, too (and perhaps even some of your teachers), with these intriguing, easy-to-do experiments. Best of all, you'll find that you have a wonderful time doing them.

# *The* REAL BOOK *of* *SCIENCE EXPERIMENTS*

## AIR IS AMAZING

HARDLY ANYONE pays much attention to the air. It is invisible, and we never feel it unless a strong wind rushes along, blowing things before it. But even though we are rarely conscious of it, the air is always round us. It is an amazing and very powerful substance, with characteristics that few people know anything about.

We live in a world that is always in motion. Even still air and ice and solid rock are filled with movement. This movement is the dancing of the tiny

molecules that make up all matter. (A molecule is the smallest possible unit of a compound.) The molecules, in turn, are made up of still tinier atoms, which are the smallest units of elements.

In air, which is a mixture of gases, this dance takes the form of a fast free-for-all, in which the individual molecules move at speeds of nearly 250 miles an hour and bump into other molecules five thousand million times a second. Our skin receives the impact of these countless tiny "bullets," and it registers on our bodies as air pressure. Usually we don't feel this pressure because it is equalled by pressure from inside our bodies.

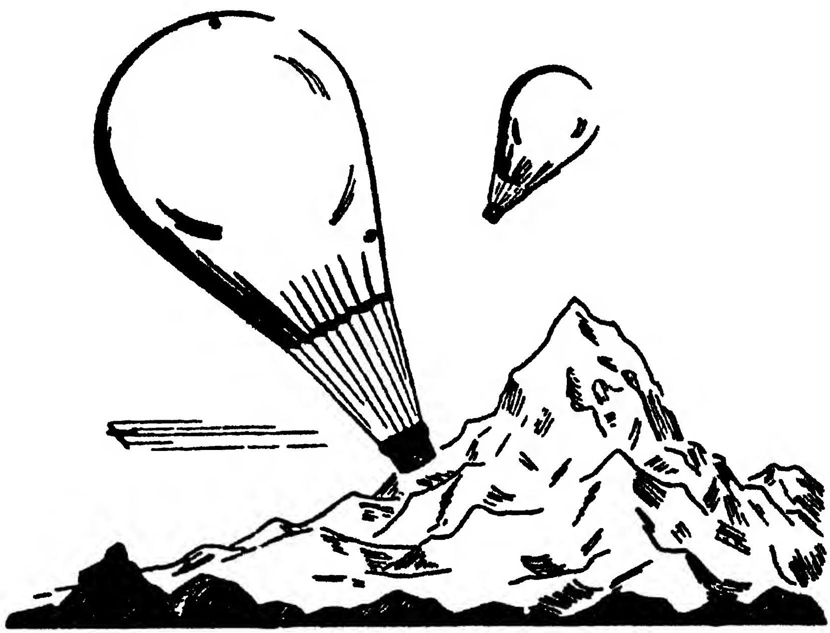
Air pressure is so great that air is sometimes called an "invisible giant." At this very minute your body is supporting fourteen tons of air pressure. That is the weight of air that is pressing against you.

The weight of small quantities of air is, of course, very slight. But when you realize that every square foot of the earth's surface supports a column of air over two hundred miles high, which exerts a pressure of almost a ton on each square foot of surface, you can see that the weight of this much air mounts up.

Air is a mixture of 21 per cent oxygen and 78 per cent nitrogen. The other one per cent consists of rare gases called argon, neon, krypton, etc.

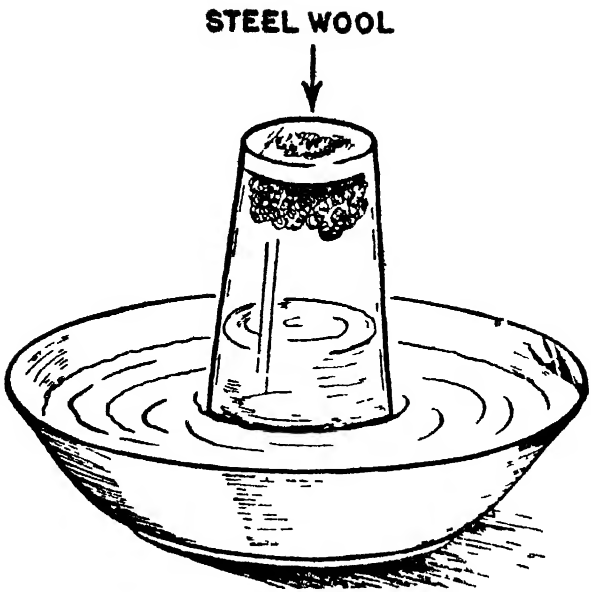
Another interesting thing about air is that it contains at all times large quantities of water vapour. We can rarely see this water, but it is there just the same, like a huge invisible ocean over our heads.

In the following experiments you can demonstrate how powerful air pressure really is. You can weigh air, compress it, pour it, and make it obey your commands in several other ways.



## How to Take Oxygen Out of the Air

It may hardly seem possible that, in your own home and without expensive laboratory equipment, you can draw oxygen right out of the air. Yet it is




one of the easiest experiments in this whole book!

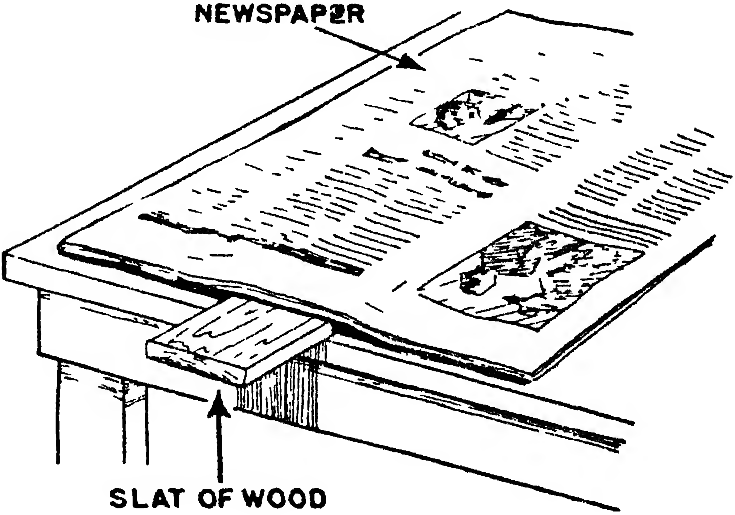
All you need is a tumbler, a soup plate, and a little steel wool. (This is used for cleaning pots and pans.)

Tear off enough steel wool to cover the bottom of the glass. Run some hot water into the kitchen sink and put a piece of soap in the water. Let the soap dissolve until you have a good soapy solution. Wash the steel wool in this solution in order to get rid of any protective oily covering there may be on it.

When the steel wool has dried, wedge it tightly in the bottom of the glass. Then fill a soup plate with water. Turn the glass upside down and stand it on the plate.

The oxygen in the air will be attracted to the iron

in the steel wool, and soon will start rusting it. As this goes on, the steel wool will absorb more and more of the oxygen, and the water will be pushed up into the glass by outside air pressure to fill the space previously occupied by the oxygen. Within a few hours the process will be completed. Almost all the oxygen will be drawn out of the air, and the one-fifth part of the glass that it formerly occupied will be filled with water.




## How to Prove the Strength of Air Pressure

Here is a very easy and dramatic way to prove how great air pressure is.

Get a very thin piece of wood about three feet

long and four inches wide. (A thin slat from a fruit crate is good.) Lay the slat on a table so that one end sticks out about four inches beyond the table edge. Then put two double sheets of newspaper over the part of the wood that is on the table. Put the papers one on top of the other and smooth them down with your hand, pressing them close against the slat and the table.

Now strike the end of the slat a hard downward blow with your closed fist or, better still, with a cricket bat. You might expect this to throw the paper into the air. But the air says, "No, you don't. I'm heavy enough to stop any nonsense like that." It presses down so hard on the paper that the slat breaks beneath your blow!

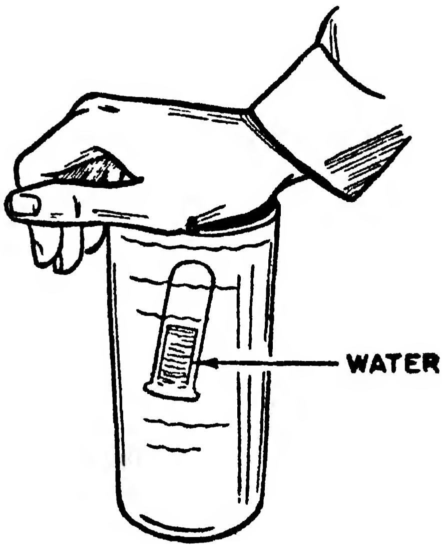
It is hard to believe that air has as much pressure as this. But if you work it out, remembering that air exerts a pressure of almost one ton on every square foot of surface, you will see that it exerts a pressure of more than five tons on an outspread double sheet of newspaper. It is almost as if five tons of bricks were piled up on top of the paper.

## How to Make Water Compress Air

If you blow up a balloon to a good size, and then decide to blow it up a little fuller, you can do so. The balloon will expand a little, and at the same time you will pack in the air more tightly. You can com-

press air so as to fit more of it into a given space.

But water is different. When you fill a glass to the brim with water, the glass is full. You just cannot compress the water in order to put more of it into the glass.




With a tall tumbler and a straight-sided medicine phial you can show how air compresses and water does not.

First fill the tumbler almost to the brim with water. Then fill the phial about half full. Turn the phial upside down and float it in the tumbler. You will probably have to try a few times before you get just the right amount of water in the phial. It should just barely float.

Now cover the rim of the tumbler completely with the palm of your right hand. Press your palm down hard and a little way into the tumbler. This pressure on the water will force water up into the phial. The new water will compress the air in the phial. The phial will be heavier because it contains more water. As a result, it will sink down towards the bottom of the tumbler.

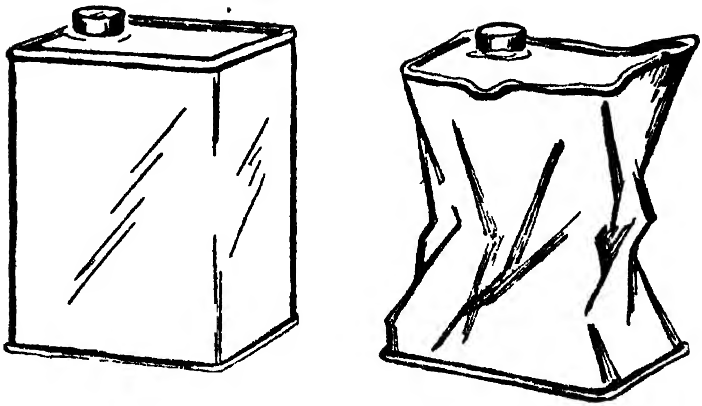
Raise your hand and the phial will rise as the compressed air in it forces out some of the water.

### How to Make Air Pressure Crush a Tin Can

You do not feel the great pressure of air against your body because the pressure inside your body equals that outside. If you did not have this air inside your body, the outside air pressure would squash you flat The same is true of a house. If you could remove all the air from inside a house, the outside air pressure of many hundreds of tons would instantly crush it like an eggshell

You can demonstrate this enormous crushing power of the air very easily by using an empty straight-sided one-gallon can with a screw-on cap, plus the kitchen stove. Paints and varnishes come in cans of the kind needed. If you do not have one, you can probably get an empty one at a hardware shop.

To start the experiment remove the screw cap and pour half a cup of water into the can. Put the can



on the stove and bring the water to the boil. (This will fill the can with steam, which forces out all the air. But the pressure of the steam inside the can will balance the pressure of the air outside.) Let the water boil for several minutes. Then lift the can from the stove and put it in a pan on the table. As soon as the amount of steam coming out of the top of the can lessens enough to permit, screw on the cap tightly.

Now pour some cold water over the can to hasten its cooling off. This is what happens: The steam cools and changes to water. The can is then no longer completely filled with anything—water, steam or air. Instead, there is a partial vacuum inside it. The substances inside the can are not strong enough to equal the force of the outside air pushing against the sides of the can. Soon, with loud moans and groans, the outside air crushes in the sides of the can.

## How to "Pour" Air

Everybody knows that you can pour water or milk or any other liquid. But very few people realize that you can, or so to speak, pour air, too!

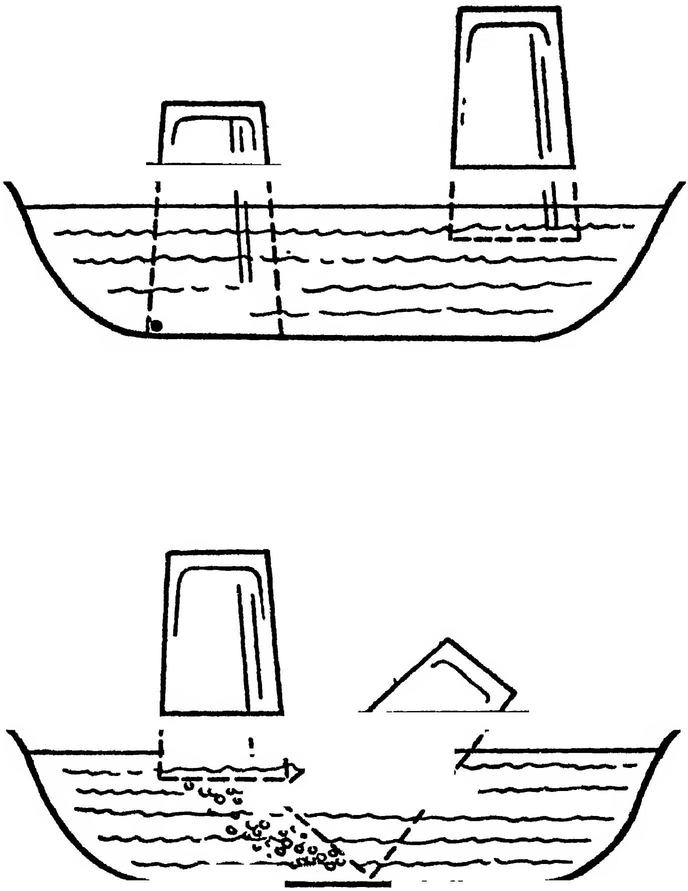
Fill a large basin with water or, if you have no big basin handy, fill the kitchen sink or wash-basin. Put two tumblers within easy reach. Fill one with water by dipping it into the basin. Turn it upside down and set it down that way without losing any of the water.

Turn the second tumbler upside down and hold it in the basin without letting it touch the bottom. It is full of air. You will see that no water comes up into it because the air is a real substance and occupies all the space in the tumbler.

The next step is to pour the air from this tumbler into the first tumbler. Move the second tumbler close to the first one. Then tip it a little and move its mouth under the mouth of the first tumbler. Lift up the first tumbler to make this possible.

As you tip the tumbler the air inside it will bubble out and will rise up into the other tumbler, forcing the water out. At the same time water will flow into the tumbler that was filled with air. You are "pouring" air from one glass into the other.

Actually the air is squeezed into the tumbler by the greater weight and pressure of the surrounding water, very much as a slippery orange pip can be squeezed and made to fly off into space by the pressure of your thumb and forefinger. Because air can-



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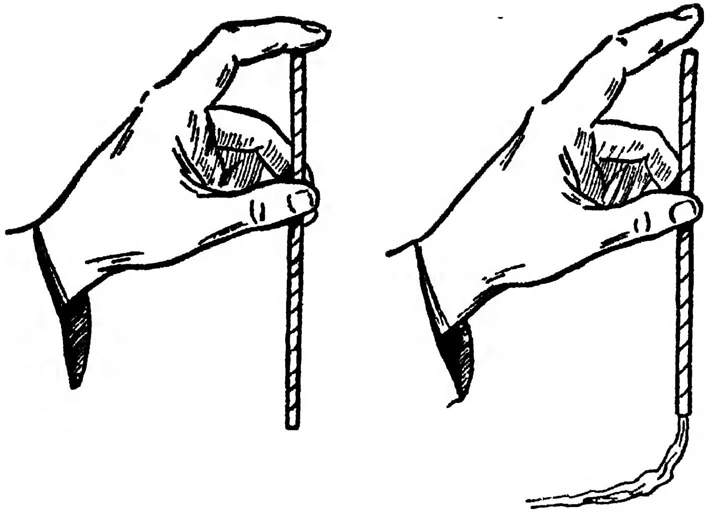
not be dissolved in water and is much lighter than water it is very easily pushed upward by the water.

## How to Block Air Pressure with Your Finger

Put some water in a sink or wash-basin. Lay a drinking straw in the water so that the straw will be

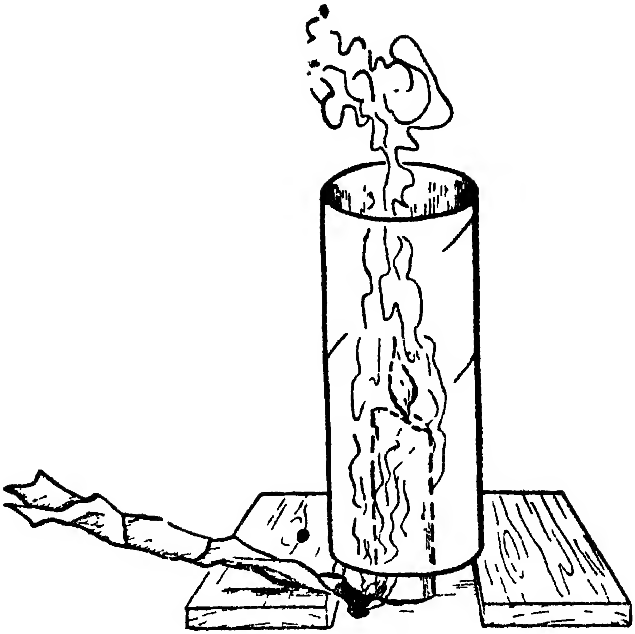


filled with water. Pick up the straw, putting your finger over the upper end, and lift it clear of the water. The water inside the straw will not run out because your finger and the air pressure below it prevent the air above from pushing it out.

Lift your finger, and immediately the invisible giant gets to work. The air presses down on the water and forces it out of the straw, overcoming the upward pressure of the air beneath.

## How to Trace Warm Air Currents

One of the interesting things about air is that when it is warm it goes up away from the earth. As air is heated it expands and becomes thinner. Since it is thinner it is also lighter than cold air,



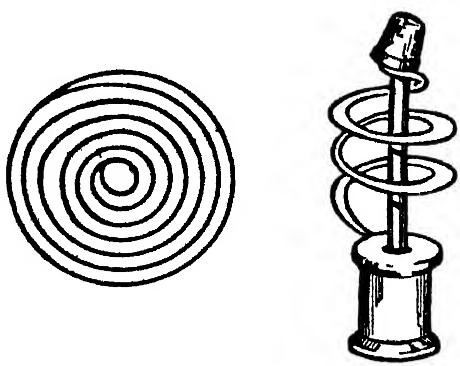
The heavier cold air is "denser" than warm air. This means that its molecules are closer together. For this reason it is drawn downward by gravity more than warm air is.

When cold air is pulled towards the earth by gravity, it pushes away the warm air that is near the floor or the earth. We say that warm air "rises," but it is really pushed up by the dense cold air that flows down and takes its place.

A good way to demonstrate how warm air rises is shown in this experiment. Put a lighted candle on the ground between two pieces of wood or two flat stones. Then put a cardboard tube over the candle. This will fill the tube with warm air.

Now roll up a paper napkin or a paper towel; touch a lighted match to one end and then quickly blow out the flame. This will make the paper smoke. Pick up the tube and hold the smoking end of the paper near the bottom of the tube. The warm air in the tube, which is rising, will draw the smoke up with it.

The hot sun creates many columns of heated air that move upward in this way, and aviators are very familiar with them. They call them "thermals," from the Greek word *thermos*, meaning "hot." These currents, rushing up from the ground, often toss aeroplanes around as though they were leaves or pieces of paper.



**A Warm-Air-Current Detector**

If you make a warm-air-current detector like the one shown in the diagram, you can locate thermals in many places, both indoors and outdoors.

The detector is made from a circle of paper about five inches in diameter. Draw a spiral line on the paper and cut along it with a pair of scissors. Leave a circle about the size of a shilling in the centre.

Put a thimble on the centre and draw round it with a pencil. Then, using a sharp-pointed knife, cut this circle out of the centre.

Push a pencil into a spool and put a pin into the pencil's eraser. Then put the thimble on top of the pin. It can revolve easily because there is very little friction between it and the pin. Put the spiral of paper round the pencil as shown in the diagram.

Now, when you place the detector on a radiator or over an electric-light bulb or any other hot place, the upward-moving warm air will make the spiral of paper revolve.

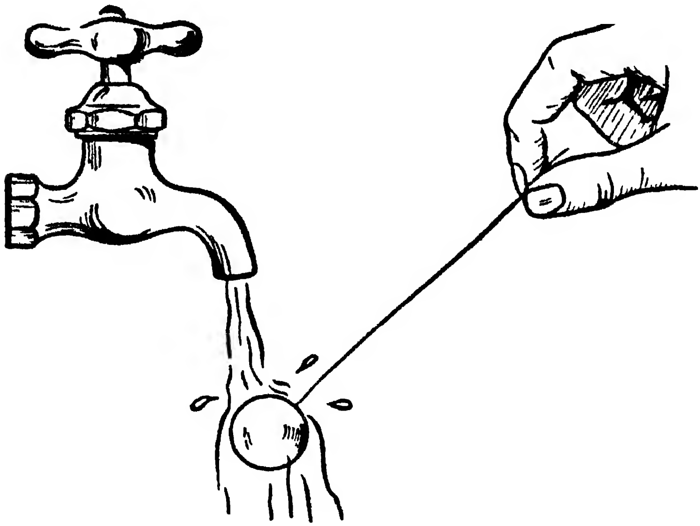
## How to Prove That Warm Air Expands

It is easy enough to say that warm air expands. But if someone says, "I don't believe it You've got to prove it to me!" how could you meet his challenge? A scientist must be able to prove that the things he says are true. This experiment proves dramatically that air expands when it is heated.

To do the experiment you will need a lemonade bottle, a balloon, and a saucepan. Squeeze the air out of the balloon and then fit the mouth of the balloon over the top of the bottle. Put the bottle in the

saucepan and fill the pan half full of cold water. Then heat the water by putting the pan on the stove.

As the water heats it will warm the air inside the bottle. The air will expand Needing more space, it will rise and blow up the balloon.



## How to Make Air Pressure Overcome Gravity

This experiment sounds impossible—but try it!

All you need is a ping-pong ball fastened with tape to one end of a piece of string about a foot long. Take the ball to a sink or wash-basin, turn on the cold-water tap, and hold the ball in the stream of

water. Then slowly move the string to one side, away from the water.

You would expect the string to draw the ball with it and leave the stream of water. But some mysterious force is at work. Instead of leaving the water, the ball will cling to it. The string will soon be out at an angle instead of straight up and down with the ball hanging from it.

What is it about the water that seems to defy gravity and hold the ball and string at an angle? It is the fact that the pressure of the water flowing over the ball is much less than the pressure of the nearby air. The air pressure is so great that it keeps pushing the ball into the area of lower water pressure.

## The Card That Won't Blow Away

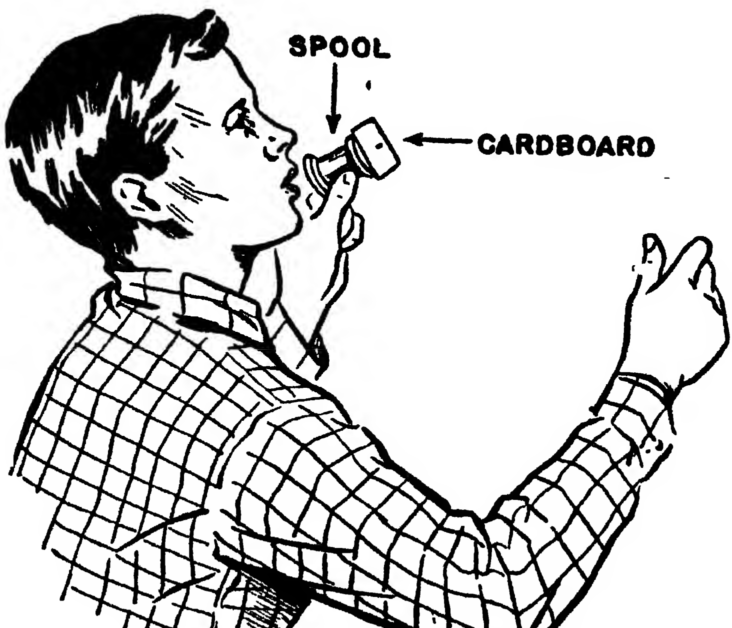
This is another surprising experiment that shows the power of air pressure.

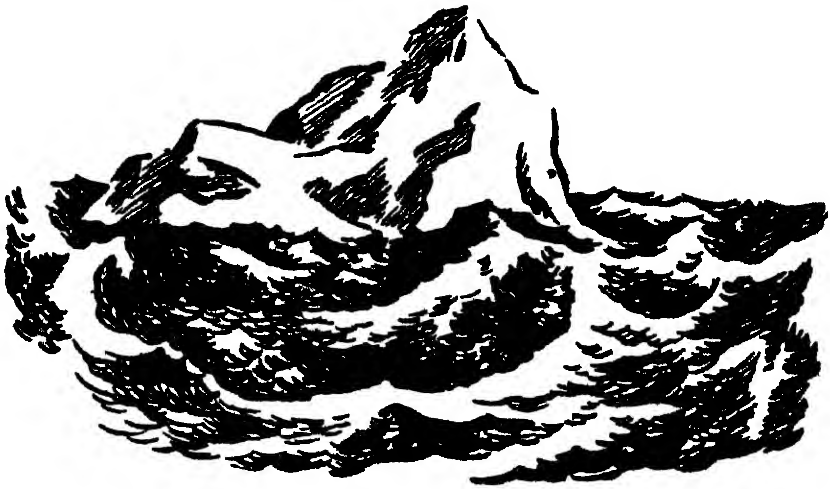
Get a spool, a small square of cardboard, and a pin. Stick the pin half-way through the centre of the cardboard. Then hold the cardboard against one end of the spool so the pin fits in the centre opening of the spool, and blow smoothly and steadily into the other end. Instead of being blown away, the cardboard will stick fast to the spool as though it were glued in place!

The explanation is that the swiftly moving air you blow through the spool and against the card exerts

less pressure against the card than does the undisturbed air on the opposite side. The moving air, trying to escape at the sides of the card, does not push as hard against the card as the still air does.

This creates a small area of low pressure between the spool and the card. The air on the opposite side of the card immediately tries to fill up this low-pressure area and, in doing so, forces the card against the spool.





## THE WONDERS OF WATER

WATER is one of the most interesting substances a scientist can study. It is something that we see in three totally different forms. We see it as a liquid, as a solid when it has been changed into ice, and as a gas when it has been heated and turned into steam. All substances from air to metals can be changed from one state to another, but we usually do not see them in all three forms.

Like every other kind of matter, water is composed of millions of tiny molecules. The molecules in water do not dance about as fast as they do in air.

Instead, they slip past each other at slower speeds and the dance is more of a glide. When you heat water, however, the molecules speed up and jump round excitedly in every direction.

In the following experiments you will be able to expand water, make it lighter in weight, make it denser and heavier, and demonstrate other facts about it which you may not have known before.

## How to Show that Heat Makes Water Lighter

To do this experiment you will need a tumbler, a small pill bottle, and a fountain pen containing ink.

Fill the tumbler nearly full of cold water; then pour cold water into the pill bottle until it is about two-thirds full. Put the point of the fountain pen into the bottle and push the plunger on the pen in order to force a few drops of ink into the water. Put the bottle right side up in the tumbler. Because the water in the bottle is cold nothing will happen. The ink-coloured water will stay in the bottle.

Now empty the bottle and refill it two-thirds full of hot water. Put a few drops of ink in it, as before, and set the bottle in the tumbler. At once an inky stream will start to rise up from the bottle. Because the water is hot, it is lighter and has less density than the cold water in the tumbler. When the inky

water cools, it will become heavy again and will sink towards the bottom of the tumbler.

## How to Increase the Density of Water

If you put an egg into a glass of water, it will immediately sink to the bottom. This is because the egg is denser than the water. Since it is denser, it weighs more than does an equal volume of water. A piece of any common wood, however, will float in water because it is less dense. It is lighter than an equal volume of water.

You can make an egg float in water by increasing the density of the water. Simply add two heaped tablespoonfuls of salt to half a pint of water and stir with a spoon until the salt is dissolved. The salt will increase the water's density so that a given amount of salt water will weigh more than the same amount of pure water.

Put the egg in the water again, and this time it will float. The water now has greater density than the egg.

This experiment illustrates why it is so easy for people to float in the Great Salt Lake in Utah, or in the Dead Sea. The water of the Great Salt Lake and the Dead Sea is very dense because of the huge amount of salt dissolved in it.

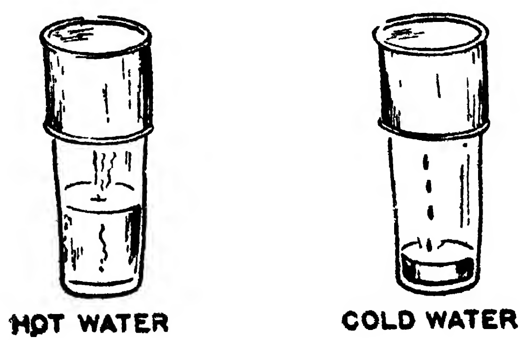
## Hot- and Cold-Water Race Shows Molecular Action

You have seen that when water is heated it gets lighter and expands. Now you can show that something else happens too. This is that heat speeds up the activity of the molecules in the water.

You can demonstrate this by staging a race between hot and cold water. Get two small tin cans of the same size and shape. Make a small hole with the point of a sharp nail or a tin-opener in the bottom of each can. Fill one can with iced water and the other one with hot water. Then put each can on top of a tumbler and watch what happens.

The hot water will flow into its tumbler much faster than the cold water. Simply by heating the water you have caused an important change in the actions of its millions of individual molecules.

In cold water the molecules move slowly and tend to cling closely to each other. But when you heat



water, the heat stirs up the molecules and makes them hurry about. In their hurry, they stop clinging to each other and, instead, they slide rapidly over each other.

## How to Show that There is Space between Water's Molecules

To do the experiment, fill a tumbler to the brim with water. Then take a salt-cellar full of salt and pour the salt very slowly into the water. As you do this, keep stirring the water constantly with a straw taken from a broom or a piece of thin wire.

You will probably be able to empty the entire contents of the salt-cellar into the glass. There will be a small increase in the volume of the water, but it will be only a fraction of the combined volume of the salt and the water.

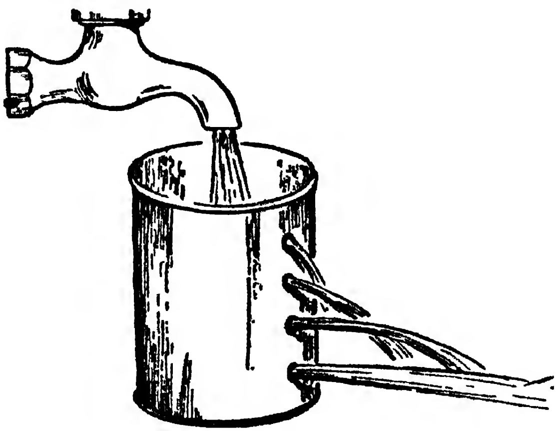
The explanation of this experiment is probably that there are empty spaces between the molecules of the water. These spaces, though invisible, are large enough to hold the molecules of the dissolved salt.

## Water Pressure Increases with Depth

You do not have to put on a diver's suit and go

down into the water to prove how quickly water pressure increases the deeper down you go. You can do it just by getting an empty tin can and punching four holes in it, one right under the other. (You can use an awl or even a nail.) Then hold the can under a tap and turn on the water.

As soon as the can is full, streams of water will come out of all the holes. You will see that the two lower streams shoot out much farther than the two upper ones. This is because the water near the bottom of the can exerts much greater pressure than the water near the top.



## How to Make Water Lift a Person

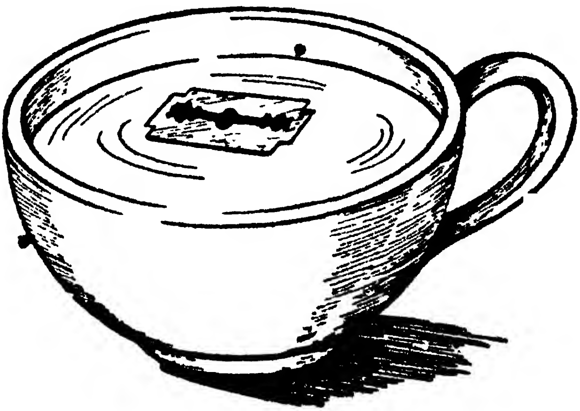
When you put flowers in water, the water pushes up through capillary tubes in the stems. ("Capill-

ary" means "hairlike" or very small.) Many substances such as paper and cardboard have tubes of this kind, and water pushes into them in the same way as it flows into the capillary tubes of flower stems. This is known as "capillary action."

This experiment shows the great force exerted by water in capillary action. Get two tin cans of the same size and shape and cut off their tops smoothly. Then cut out a number of squares of porous cardboard or corrugated board. You should have enough

squares to fill each can up to the level of the open top.

Ask a friend to stand on the cans, and then pour water into both cans. As the water pushes into the minute capillary tubes in the cardboard, it will make the cardboard swell so much that your friend will be lifted several inches into the air!



## How to Float Steel on Water

Everybody thinks that a piece of metal dropped into water will immediately sink to the bottom. But you can make a steel object which is much denser than water float on the surface of the water!

To do the experiment, fill a cup with water and then put a razor blade on the prongs of a fork. Lower the fork slowly and carefully into the water. When

the razor blade rests on the water, it will float there.

This is possible because water has an invisible skin that is called "surface tension." This is caused by the action of the molecules on the surface of the water. When they are in contact with air, they are attracted more strongly than usual to the water to which they belong. They do not want to join the air and are repelled by it. This packs them more tightly together and makes them form a strong surface layer of molecules on top of the water.

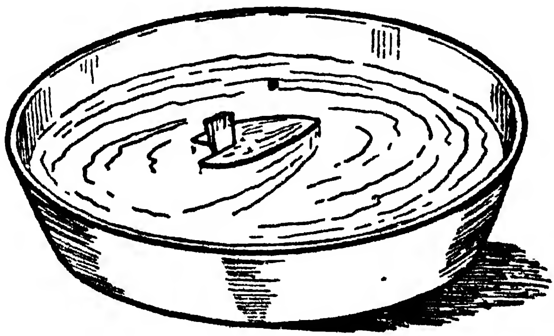
This layer is dense enough to support a razor blade or a steel needle. It is also strong enough to support flies and water insects, which can walk on top of the water.

## How to Make Water's Surface Tension Propel a Boat

You can use the surface tension of water to propel a little boat round a bowl of water at a good rate of speed. People who do not know their science will wonder what it is that makes the boat go.

Cut a piece of cardboard or very thin wood into the shape of a boat about an inch and a half long. With a knife make a V-shaped slit in the stern and wedge a small thin piece of soap into the slit. Then fill a pan with water and put the boat on the water. The boat will immediately start to move forward, just as though it were propelled by a motor,

The reason for the boat's motion is this: As the soap slowly dissolves, it lowers the surface tension of the water at the stern of the boat, making the tension just behind the boat lower than the tension in front of it. The boat will keep moving until the surface tension of all the water in the pan has been lowered by the soap.



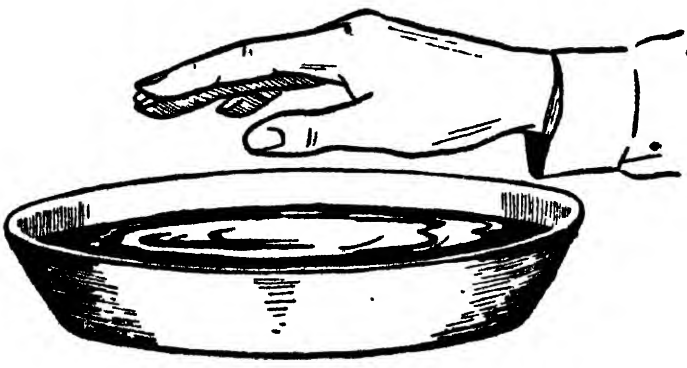
## How to Waterproof Your Skin

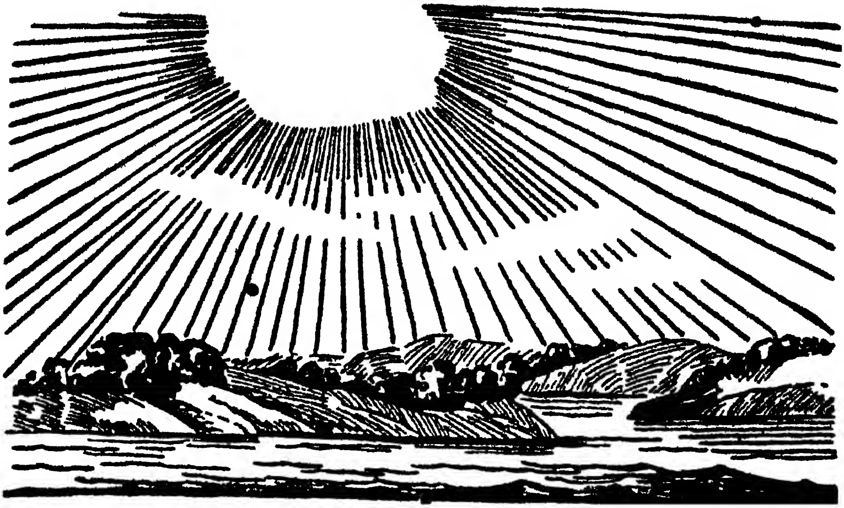
This experiment looks like magic, but it is basea on a scientific principle. You can have a good time showing it to your friends. In front of them you fill a bowl with ordinary water. Then you dip your hand in the water and bring it out absolutely dry.

You do the trick by rubbing zinc stearate dusting powder all over one hand, including the fingers. Use pressure when you are rubbing it on so that it will get into your skin. It is perfectly harmless. Then,

when you put your hand in the water and take it out again quickly, your hand will remain dry.

The explanation is that water molecules are repelled by the zinc stearate. Ordinarily, when you put your hand in water it becomes wet because water molecules are attracted to your hand more strongly than they are to each other. But when zinc stearate is on your hand, the water molecules cling more closely together and stay in the water.





## HAVE FUN WITH HEAT

THE HEAT with which all of us are most familiar is the warmth of the sun. But we also know of the heat given off by coal fires, stoves, radiators, wood fires, and even candles. Heat is a very powerful and active force. It stirs up the molecules in everything it touches and makes them dance at a faster pace.

In addition to warming things, heat also makes many things grow larger or expand. When you heat water or other liquids, they expand. When the sun heats the mercury in a thermometer, it expands and pushes its way up the tube of the thermometer to show a higher temperature. In the same way, heat expands gases like air or steam. It is the expansion of steam that makes a steam engine go, and it is the

expansion of heated air that drives a motor-car engine.

Heat also *expands metals.* That is why there is always a space between the ends of the rails in a railway track. It leaves room for the rails to expand in hot weather. Scientists have calculated that the difference in length between winter and summer of the rails of a stretch of track 500 miles long is about 1,400 feet, or a quarter of a mile.

Heat is a form of energy that travels through the

air in waves. Heat waves and light waves are much the same except in length. Heat waves can be reflected and broken up just as can light waves.

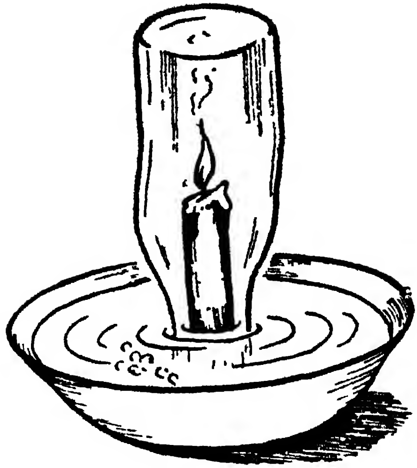
Another scientific fact about heat is that it travels at different speeds through different substances. All substances conduct heat, but some conduct it so slowly that they are called insulators. Metals are usually good heat conductors while both air and water are poor conductors.

There is tremendous energy in heat. If you wanted to heat enough water for a bath, you would have to raise the temperature of twenty-five gallons of water about fifty degrees. This would require three million calories of heat energy. These three million calories, in the form of free energy, would be enough to lift a weight of one hundred pounds straight up into the air a distance of twelve and a half miles.

## How to Make Heat Draw Oxygen out of the Air

Light a candle and stand it in the centre of a soup plate. Fasten it firmly in place with a few drops of melted wax. Then fill the plate almost completely full of water. When the candle is burning steadily, cover it with a milk bottle.

The candle will immediately start to heat the air inside the bottle and make it expand. Trying to escape, some of the air will bubble out into the water in the plate. Then, as though by magic, the water will start to climb right up into the bottle.



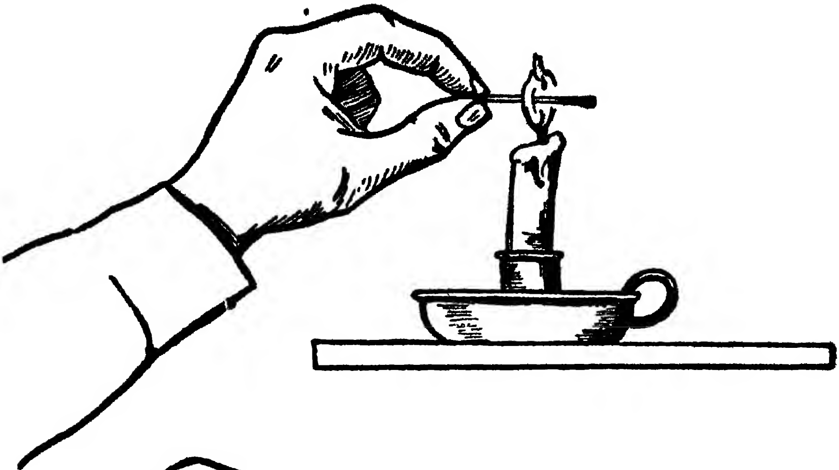
After it has risen nearly to the top of the candle, the candle will suddenly go out.

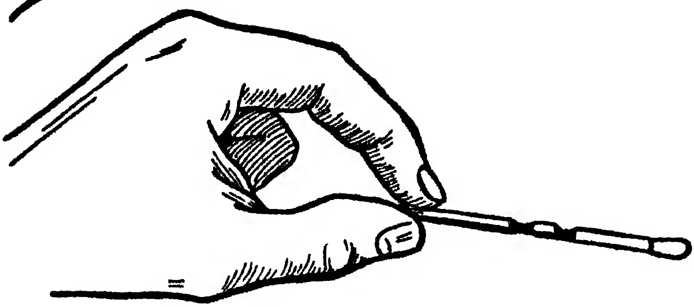
What makes the candle go out? The answer is lack of oxygen. As the candle burns, the oxygen in the air inside the bottle is used up. The flame must have oxygen to burn, so after a while it goes out.

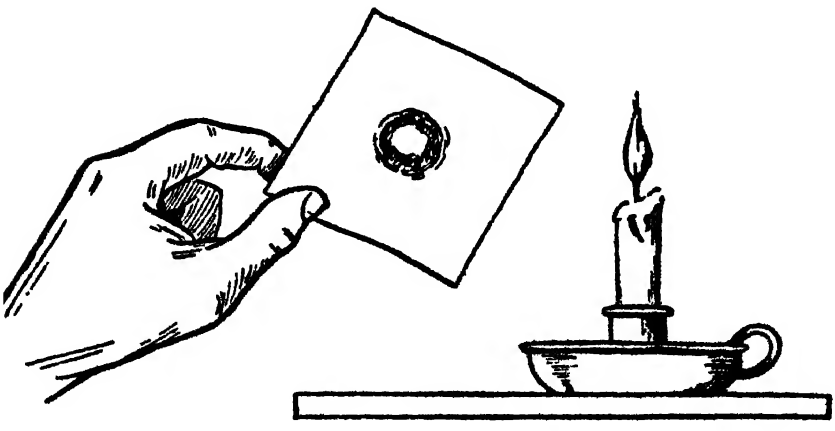
Because the oxygen is gone, the remaining air in the bottle has a lower pressure than the outside air. Then the outside air, pushing against the water in the plate, forces it up into the bottle.

## How to Show that a Hot Flame Has a Cold Centre

This experiment demonstrates a very strange fact about flame. Though most of it is too hot to touch without burning your fingers, there is a cold spot in its centre.







The flame of a candle is not made of burning wax, as you might suppose, but is burning gas. In order to burn, a substance must be changed to a gas. This is done by heating it.

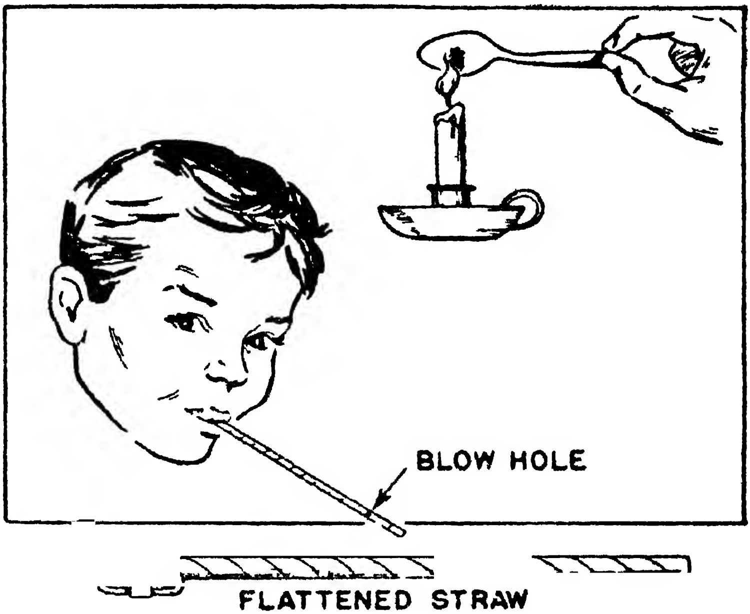
Candle wax is made of oily and fatty substances containing carbon and hydrogen. When you light a candle, the wax is drawn up to the burning wick by capillary action. The heat from the wick turns the wax into gas in the same way that heat turns water into steam.

The wax vapour forms the unlighted area of the flame just above the wick. There is no combustion there because there is no oxygen. It is not until the vapour spreads out and joins the oxygen in the air that it begins to burn. This is why a candle flame consists of a hot outer layer of burning wax vapour, with a cool area inside it.

You can prove that this is so by lighting a candle and holding a matchstick in the flame for a moment or two. When you remove the matchstick, you will see that it has been burned at two places—where the two hot outside parts of the flame touched it. The part between these two places will not be burned.

Another way to do this experiment is to hold a small square of stiff paper horizontally and move it quickly through a candle flame about a quarter of an inch above the top of the wick. Hold it steady in the flame for a fraction of a second, but do not let it catch fire. When you remove the paper, there will be a scorched ring on it formed by the hot out-

side ring of the flame. The centre of the ring, which was above the cool part of the flame, will be unscorched.




**How to Collect Carbon from a Candle Flame**

This experiment is in two parts. First you collect some of the carbon that forms part of a candle flame. Next you burn the carbon by feeding oxygen to it with a drinking-straw blow lamp.

A candle flame gives off light because bits of carbon in it become white hot. This state is called "incandescence." In the same way the electric-light bulb gives off light because electricity heats the filaments in it to incandescence.

The laboratory equipment needed to collect the carbon consists of a candle and an old spoon. Don't use a good spoon since it will probably get stained.

The carbon you are going to collect comes from the candle wax, which contains hydrogen and carbon. Soon after you light a candle the hydrogen combines with the oxygen of the air to make water. The carbon combines with oxygen to make carbon monoxide and carbon dioxide. With a spoon you can trap some of the carbon before it unites with oxygen to form these invisible gases.

All you have to do is hold the spoon beside the flame so that the flame touches its underside for a few seconds. The spoon will then be coated with carbon. This carbon is commonly known as lamp-black. If you had allowed the carbon to stay in the flame, it would have been heated until it glowed and formed part of the flame.

With a home-made blowlamp, you can heat the carbon hot enough to burn. Make the blowlamp by flattening one end of a straw and bending the flat part back on itself three times. Fasten the folds with gummed tape. Then make a pinhole in the straw near the folds.

Dip the straw in water. Then hold it close to the candle flame and blow through it so that air is forced out through the pinhole against the flame. This will make the flame shoot out to one side. Hold the spoon so that this flame strikes the carbon on the spoon's underside. The oxygen you add to the flame will make it so hot that it will soon burn up the carbon.